NuStats

3006 Bee Caves Road
Suite A-300
Austin, Texas 78746

Stacey Bricka
512.306.9065 ext. 2240
Fax: 512.306.9077
e-mail: sbricka@nustats.com

MEMORANDUM

To: Kermit Wies, CMAP **Date:** February 23, 2007

From: Stacey Bricka and Sudeshna Sen, NuStats and Jean Wolf, GeoStats **CC:** Project Team

Re: Chicago Regional Household Travel Inventory – GPS Work Plan

The Chicago Regional Household Travel Inventory (CRHTI) is a comprehensive study of the demographic and travel behavior characteristics of residents in the greater Chicago area. The study universe is defined as households residing in Cook, DuPage, Grundy, Kane, Kendall, Lake, McHenry, and Will Counties (all in Illinois). The purpose of this memo is to document the work plan for activities comprising the GPS component of the Chicago Regional Household Travel Inventory. This includes eligibility requirements, expectations regarding the type of travel captured, and deployment activities.

For the GPS component of the 1-day survey effort, GPS equipment will be deployed to 500 recruited households and installed in up to 3 household vehicles in order to track travel by those household vehicles on the assigned travel day. After the assigned travel day, GPS equipment will be retrieved and the GPS data streams will be downloaded and converted into trips (using proprietary trip-detection algorithms). The GPS-determined trips will be compared to those reported by the vehicle drivers during the CATI retrieval interview in order to document levels of household vehicle trip under-reporting. Regression models will be used to develop trip correction factors. Although not part of this study, the GPS data includes second-by-second vehicle movement tracks which can be analyzed for other important transportation issues such as route choice, speed flows, travel time reporting, and vehicle miles traveled.

ELIGIBILITY DEFINITION

Households recruited into the 1-day survey component of the CRHTI are considered eligible for the GPS survey if they own vehicles with known working cigarette lighters/power outlets and they meet one of the following criteria:

1. At least one of the household members travel 100 miles within the Chicago region on a typical weekday
2. At least one of the household members drive into Chicago for personal or business reasons three or more times a week on a weekday

The presence of working cigarette lighters/power outlets in the vehicle is an important consideration to ensure that GPS data is collected from the households recruited for this survey. Currently, as per the afore-mentioned definition, only households with at least one vehicle are considered eligible for this survey and only if they confirm that at least the three most-frequently used vehicles have functioning cigarette lighters / power outlets.

Clearly, the current definition restricts the eligibility for GPS survey to households that own vehicles with working cigarette lighters/power outlets in addition to exhibiting the desired travel behavior. In other words, if a household owns two vehicles, and only one vehicle has a cigarette lighter/power outlet, that household is considered ineligible for the survey regardless of their travel patterns. This decreases the number of households eligible for the survey (as indicated in the table below). However, on the positive side, this definition ensures that the vehicular travel patterns of the entire household are captured rather than restricting it to household members using vehicles in which the GPS devices could be installed effectively.

To finalize the eligibility requirements of the GPS study, we need to determine whether the current definition of an eligible household is adequate for purposes of this study or if it is too restrictive. The following analysis was conducted to guide this discussion. In this discussion, we consider the following definitions:

- "GPS possible households" are those who indicate they have the desired travel patterns,
- "GPS eligible households" are those who have the travel patterns and confirmed cigarette lighter functionality, and
- "GPS recruited households" are those who agree to participate in the GPS study.

Note that as the study begins, there will be a fourth group "GPS deployed", which are those households who receive units for their vehicles.

TABLE 1. HOUSEHOLDS ELIGIBLE FOR GPS SURVEY AS OF 2/16/07

	Frequency
GPS possible households	101
GPS eligible households	85
GPS recruited households	65
Total number of households recruited	440

To date, we have recruited 440 households for the 1-day survey. Out of the 440 households, 101 are GPS possible households *i.e.* households that meet the requirements for GPS survey based on their travel characteristics but might or might not have cigarette lighters/power outlets in their vehicles. Furthermore, out of the 101 GPS possible households, 85 households are eligible for the GPS survey (according to the current definition of all three vehicles having known functioning cigarette lighters), of which 65

households have agreed to participate in this survey. Table 2 and 3 shows the distribution of the GPS possible, GPS eligible and GPS recruited households by county and strata as compared to other households.

TABLE 2: DISTRIBUTION OF HOUSEHOLDS BY COUNTY

County	Total Households Recruited	Total GPS Possible Households	Total GPS Eligible Households	Total GPS Recruited Households
Cook	244	51	43	34
DuPage	51	13	12	9
Grundy	1	1	0	0
Kane	33	7	6	4
Kendall	8	2	2	2
Lake	45	8	6	4
McHenry	23	7	6	4
Will	35	12	10	8
Total	440	101	85	65

TABLE 3: DISTRIBUTION OF HOUSEHOLDS BY STRATA

Strata	Total Households Recruited	Total GPS Possible Households	Total GPS Eligible Households	Total GPS Recruited Households
1	139	35	27	20
2	109	25	22	16
3	102	25	23	18
4	54	13	10	8
5	36	3	3	3
Total	440	101	85	65

In comparing the distribution of households that are possible GPS recruits to those eligible based on lighter functionality, it appears that the potential bias introduced is consistent across the county and strata delineations. At this point in time, we recommend keeping the definition as-is to maximize the GPS data streams obtained from each household, but we recommend monitoring these distributions weekly and if there appears to be a growing bias, to revisit the definition.

EXPECTATION

Based on the distribution of GPS eligible households in the current CHRTI recruitment data, we expect the 500 GPS surveys to be distributed similarly. These surveys will be distributed in proportion to the GPS-eligible households within each of the counties and stratification levels. Table 4 and 5 indicate the expected distribution of the 500 GPS surveys.

TABLE 4: GPS SURVEYS GOALS BY COUNTY

County	Total GPS-Possible Households	% of GPS-Possible Households	Total GPS Survey Households	% of GPS Survey Households
Cook	51	50%	252	50%
DuPage	13	13%	64	13%
Grundy	1	1%	5	1%
Kane	7	7%	35	7%
Kendall	2	2%	10	2%
Lake	8	8%	40	8%
McHenry	7	7%	35	7%
Will	12	12%	59	12%
Total	101	100%	500	100%

TABLE 5: GPS SURVEY GOALS BY STRATA

Strata	Total GPS-Possible Households	% of GPS-Possible Households	Total GPS Survey Households	% of GPS Survey Households
1	35	35%	173	35%
2	25	25%	124	25%
3	25	25%	124	25%
4	13	13%	64	13%
5	3	3%	15	3%
Total	101	100%	500	100%

EQUIPMENT DEPLOYMENT

Households are recruited into the travel survey approximately 8 to 12 days prior to their assigned travel date. Throughout the study period, NuStats sends GeoStats a cumulative database that contains GPS study recruit information (such as name, address, phone numbers, sample type, household persons and household vehicles) at least three times each week. These data are then posted to the GeoStats password-protected GPS Study deployment website, where the deployment team can access the recruit list to make delivery scheduling calls. GPS deployment goals by geographic strata will also be tracked and managed on this website.

The deployment method used for this study is a delivery and pickup approach using local retired police officers or their family members, coordinated through a subcontractor. Deployment team members from throughout the region were selected in order to provide adequate coverage for the anticipated distribution of CHRTI study households. This method has proven to work very well in past studies; in fact, no equipment has been lost in any of the GPS studies conducted by GeoStats using this method.

Passive in-vehicle GPS data loggers will be provided for up to three household vehicles for the 500 households participating in the GPS component of this study. In addition to receiving GPS equipment, each household is provided with paper travel logs that are sent by mail from DataSource. At the time of equipment delivery, which is scheduled for one to two days prior to the assigned travel day, the deployment person will offer additional travel logs if the mailed travel logs have not yet arrived.

During the delivery process, the deployment person will make an appointment for retrieval of the GPS units, which will typically be the day following the assigned travel date. When the equipment pickup is made, the deployment person will ask the household members about equipment and vehicle usage for the travel day.

GeoStats has provided 44 GPS Data Loggers (the GeoStats in-vehicle GeoLogger) to enable attainment of the deployment goal of 10 households per week. The extra loggers are provided to account for possible pickup delays and the large geographic scope of the Chicago region. After retrieving the equipment, the deployment team will download the GPS data, verify a successful transfer, and reset the GeoLogger memory for redeployment. The downloaded GPS file will then be posted to the project website and loaded into the project database at the GeoStats office, where all further GPS data processing will occur. Deployment personnel also update the vehicle and equipment usage status field on the website as reported by each household.

At GeoStats, the GPS data streams are processed into trip records and compared against the CATI retrieval data. Households with "missed" trips (those detected in GPS but not noted in the CATI data) are mailed a prompted recall survey that obtains the details of the missed trips. Once the GPS survey is completed, a missed trip correction factor will be developed using regression techniques.

GPS EQUIPMENT DEPLOYMENT FOR STUDY AREA

Given the large geographic range of the Chicago study region, it was decided that the region would be subdivided into eight geographic zones defined by county and/or zipcode boundaries, with eight deployment staff located around the region contracted to cover these zones. Figure 1 shows the zones and home locations of deployment team members.

FIGURE 1. CRHTI GPS DEPLOYMENT ZONES